

DOCUMENTED CHROMOSOME REPORTS AND SUPPLEMENTARY  
INFORMATION ON PREVIOUSLY REPORTED CHROMOSOME COUNTS OF  
NORTH AMERICAN *DELPHINIUM*

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ABSTRACT

Chromosome numbers are reported from new documented counts of 21 *Delphinium* species from North America. In addition, clarifications and comments are provided for previously reported chromosome counts of North American *Delphinium*. This information is provided to support inclusion of the chromosome data in the forthcoming volume of *Flora of North America* that will contain the treatment for *Delphinium*. Two of the newly documented counts are from species not previously reported, an additional twelve include documentation for counts previously reported.

KEY WORDS: *Delphinium*, Ranunculaceae, chromosome counts, North America

Chromosome counts are documented for 85 collections of *Delphinium* from North America. These reports represent 23 taxa from 21 species. Counts for two species are reported where no previous chromosome counts are known. Counts for another twelve species are documented here, for which counts had previously been reported by Warnock but not documented. Vouchers are housed in the herbaria cited (by acronyms listed in Holmgren *et al.* [1990]) with each report. Discussion on sources of material and likelihood of accurate identifications for another 51 taxa are included. Chromosome counts for 63 taxa are summarized.

*Delphinium alabamicum* R. Kral

UNITED STATES. Alabama: Franklin Co., 0.8 mi. NW Jct. County Road 24 and County Road 99 on 24, NW facing slope, overgrown *Juniperus* glade on limestone, 30 May 1981, M.J. Warnock 2263 (ILL,MO,NO,PAC,SHST,TEX);  $n=8$  (1 plant counted).

With the exception of Warnock (1982 [ $n=8$ --based on the counts reported here]), no previous report of chromosome numbers for *Delphinium alabamicum* has been located.

*Delphinium andersonii* A. Gray

Reported by Lewis *et al.* (1951) as  $2n=16$  based on three specimens from California. All of these seem to be accurately identified.

*Delphinium andesicola* Ewan

UNITED STATES. Arizona: Cochise Co., Rustler Park Campground, Coronado National Forest, W end of meadow, E facing slope, T17S R30E Sec. 33 SW 1/4 SE 1/4, 14 Aug 1978, *M.J. Warnock 1644* (ILL,SHST,TEX);  $n=8$  (12 plants counted).

Reported as  $n=8$  by Warnock (1987) without further elaboration, but that report based on this count. No other reports on chromosome numbers of *Delphinium andesicola* have been located.

*Delphinium barbeyi* (Huth) Huth

UNITED STATES. Wyoming: Albany Co., Rt. 130, 0.2 mi. W of University of Wyoming Science Research Station Road, N of road, S facing slope along stream, 19 Jul 1978, *M.J. Warnock 1299* (ILL);  $n=8$  (29 plants counted).

Chromosome counts for *Delphinium barbeyi* have been previously reported by Crawford & Gardener (1974) as  $2n=16$  based on a specimen from Carbon Co., Wyoming. This specimen appears to be accurately identified.

*Delphinium bicornutum* Hemsl. subsp. *bicornutum*

MEXICO. Oaxaca: 7.6 mi. NE turnoff to Ixtlán de Juárez on Rt. 175, roadcut S of road, edge of mixed *Pinus*-hardwood forest, 19 October 1981, *M.J. Warnock 2539* (ENCB,ILL,MEXU,MO,SHST,TEX);  $n=8$  (3 plants counted).

MEXICO. Oaxaca: 6.5 mi. NE turnoff to Ixtlán de Juárez on Rt. 175, roadcut S of road, edge of mixed *Pinus*-hardwood forest, 19 October 1981, *M.J. Warnock 2540* (ENCB,ILL,MEXU,MO,NO,PAC,SHST,TEX,WIS);  $n=8$  (3 plants counted).

Reported as  $n=8$  by Warnock (1987) based on this count, but not further documented in that publication. No additional chromosome counts for *Delphinium bicornutum* subsp. *bicornutum* have been located.

*Delphinium bicornutum* Hemsl. subsp. *oaxacanum* M.J. Warnock

MEXICO. Oaxaca: ca. 11.5 mi. S Miahuatlán on Puerto Angel road, steep NE facing slope, *Pinus-Quercus* woods, 19 October 1981, *M.J. Warnock 2536* (ENCB,ILL,MEXU,MO,PAC,SHST,TEX,WIS);  $n=8$  (3 plants counted).

Chromosome number of *Delphinium bicornutum* subsp. *oaxacanum* reported without additional information, as  $n=8$  (Warnock 1984) based on this count. No further chromosome counts of *Delphinium bicornutum* subsp. *oaxacanum* have been located.

*Delphinium brachycentrum* Ledeb.

Langlet (1932) reported *Delphinium brachycentrum* as  $n=8$  based on a specimen cultivated at the Bergen Botanic Garden. The source of the cultivated specimen was not cited and I have not seen a voucher specimen. This report has not been included in the *Flora of North America* manuscript.

*Delphinium calcar-equitis* Standl.

MEXICO. Chihuahua: 7.8 mi. N of La Bufa turnoff on road between Creel and Guachochic, E of road, N facing slope in ravine, *Pinus-Quercus* woods, 23 Aug 1980, M.J. Warnock, J.A. Norris, & S.P. McCormick 2145 (ILL,TEX);  $n=8$  (2 plants counted).

MEXICO. Chihuahua: 15.7 mi. W San Juanito Road on road to Yepachic, S of road, steep moist N facing slope, *Pinus-Quercus* forest, 25 Sep 1981, M.J. Warnock 2372 (ENCB,ILL,MEXU,MO,PAC,SHST,TEX);  $n=8$  (3 plants counted).

Reported as  $n=8$  by Warnock (1987) without further documentation. That report based on the counts documented here. No additional counts for *Delphinium calcar-equitis* have been found.

*Delphinium californicum* Torrey & A. Gray subsp. *californicum*

Reported by Lewis *et al.* (1951) as  $2n=16$  based on two specimens from California. Both specimens represent *Delphinium californicum* subsp. *californicum*. Al-Kelidar & Richards (1981) cite *D. californicum* as a name on source material they grew and identified as *D. elatum*, and for which they report a chromosome number of  $2n=32$ . No voucher specimen has been seen.

*Delphinium cardinale* Hook.

Propach (1940) reported *Delphinium cardinale* as  $2n=16$  based on seeds received from a commercial source. Voucher specimens have not been seen, nor were they mentioned in Propach's paper. Reported by Lewis *et al.* (1951) as  $2n=16$  based on six collections from California. Specimens of the two collections from Santa Barbara Co. have not been examined, however, the other four are accurately identified. Mehlquist *et al.* (1943) report *D. cardinale* as naturally  $n=8$ , but that they were able to produce fertile  $n=16$  plants by treatment with colchicine. No seed source nor voucher specimen was cited. The latter count was not included in the *Flora of North America* manuscript.

*Delphinium carolinianum* Walter subsp. *carolinianum*

UNITED STATES. Illinois: Henderson Co., rest area ca. 2 mi. NE Dallas City on Rt. 96, T8N R6W Sec. 30 SE 1/4, hill prairie, S facing slope, 23 May 1978, M.J. Warnock 460 (ILL);  $n=8$  (22 plants counted).

UNITED STATES. Missouri: Carroll Co., 1.1 mi. W Jct. Rt. C and Rt. Z on C, N side of road, clayey shale soil, S facing slope, 23 May 1978, M.J. Warnock 464 (ILL);  $n=8$  (1 plant counted).

UNITED STATES. Illinois: Pike Co., ca. 5 mi. SE of Kinderhook on Rt. 96, E of road, bluff prairie, SW facing slope, 23 May 1978, M.J. Warnock 478 (ILL);  $n=8$  (9 plants counted)

- UNITED STATES. Missouri: Ozark Co., 4.8 mi. E Jct. US 160 and Rt. PP on 160, N side of road, shallow loose rocky soil on edge of deciduous woods, 27 May 1978, *M.J. Warnock 493* (ILL,TEX);  $n=8$  (3 plants counted).
- UNITED STATES. Missouri: Barry Co., 1.7 mi. N Jct. Rt. M and Rt. E on M, T22N R26W, SE of road above roadcut, rocky soil, 28 May 1978, *M.J. Warnock 528* (ILL,PAC,SHST,TEX);  $n=8$  (22 plants counted).
- UNITED STATES. Arkansas: Madison Co., 6.5 mi. W Jct. Rt. 68 and Rt. 21S on 68, roadside, N of road, SW facing rocky slope, 29 May 1978, *M.J. Warnock 544* (ILL,PAC,SHST,TEX);  $n=8$  (4 plants counted).
- UNITED STATES. Arkansas: Carroll Co., 5.1 mi. W Jct. Rt. 68 and US 62 on 68, T18N R22W, W side of road, SE facing slope, 29 May 1978, *M.J. Warnock 545* (ILL,TEX);  $n=8$  (1 plant counted).
- UNITED STATES. Arkansas: Marion Co., 7.4 mi. W Jct. US 62 and Rt. 202 on 62, T19N R17W, W side of road on roadcut and above, E facing slope, rocky soil, 29 May 1978, *M.J. Warnock 550* (ILL,MO,PAC,SHST,TEX);  $n=8$  (23 plants counted).
- UNITED STATES. Arkansas: White Co., 3.5 mi. N Jct. US 167 and US 67 on 167, T9N R5W, E side of road, gravelly soil, 30 May 1978, *M.J. Warnock 558* (ILL, PAC,TEX);  $n=8$  (2 plants counted).
- UNITED STATES. Arkansas: Prairie Co., 1.1 mi. E Jct. US 70 and Rt. 11S on 70, T2N R5W, between highway and railroad, low prairie, 30 May 1978, *M.J. Warnock 573* (ILL,PAC,TEX);  $n=8$  (1 plant counted).
- UNITED STATES. Oklahoma: McCurtain Co., 6.6 mi. E Jct. Rt. 70 and Rt. 209S on 70, T6S R21E, between highway and railroad, grassy area near edge of brush, 5 Jun 1978, *M.J. Warnock 677* (ILL,PAC,SHST,TEX);  $n=8$  (3 plants counted).
- UNITED STATES. Arkansas: Sebastian Co., ca. 0.5 mi. W Jct. Rt. 22 and Rt. 292 on 22, T8N R31W, S side of road, clay soil, little slope, 5 Jun 1978, *M.J. Warnock 679* (ILL,MO,PAC,SHST,TEX);  $n=8$  (3 plants counted).
- UNITED STATES. Missouri: Morgan Co., 0.3 mi. E Jct. US 50 and Rt. 5 on 50, T45N R18W, between highway and railroad, prairie, clay soil, 6 Jun 1978, *M.J. Warnock 680* (ILL,PAC,SHST,TEX);  $n=8$  (6 plants counted).
- UNITED STATES. Illinois: Henderson Co., rest area ca. 2 mi. NE of Dallas City on Rt. 96, T8N R6W Sec. 30 SE 1/4, S of road, hill prairie, loess soil, W facing slope, 19 Jun 1978, *M.J. Warnock 912* (ILL,MO,PAC,SHST,TEX);  $n=8$  (11 plants counted).
- UNITED STATES. Illinois: Henderson Co., rest area ca. 2 mi. NE of Dallas City on Rt. 96, T8N R6W Sec. 30 SE 1/4, S of road, hill prairie, loess soil, W facing slope, 19 Jun 1978, *M.J. Warnock 912* (ILL,MO,PAC,SHST,TEX);  $n=16$  (3 plants counted).

Previously reported by Lewitsky (1931 [as *Delphinium azureum*]) as  $2n=32$ , Gregory (1941) as  $2n=32$ , Keener (1976) as  $2n=16$  or 32, and Warnock (1981) as  $n=8,16$ . Source of material was not mentioned for Lewitsky's count. Gregory's count was performed on plants grown from seed at the Blandy Experimental Farm at the University of Virginia. Gregory does not mention whether or not voucher specimens were made, nor where they might have been deposited. Keener's (1976) report is without further documentation, as is that of Warnock (1981), although the latter is based in part on the counts reported here.

- Delphinium carolinianum* Walter subsp. *vimineum* (D. Don) M.J. Warnock  
UNITED STATES. Louisiana: Bienville Par., 2.4 mi. E Jct. Rt. 4 and Rt. 9 on 4, T15N R6W, S side of road, roadside ditch, E facing slope, 31 May 1978, *M.J. Warnock 588* (ILL,PAC,TEX);  $n=8$ ; (24 plants counted).
- UNITED STATES. Louisiana: Bienville Par., 0.2 mi. E Jct. Rt. 4 and Rt. 9 on 4, T15N R6W, S side of road, roadside ditch, E facing slope, 31 May 1978, *M.J. Warnock 598* (ILL,PAC,TEX);  $n=8$ ; (2 plants counted).
- UNITED STATES. Louisiana: Caddo Par., 4.8 mi. E of state line on US 79, T16N R16W, W side of road, fine grained sand soil, W facing slope, 31 May 1978, *M.J. Warnock 600* (ILL,MO,PAC,SHST,TEX);  $n=8$ ; (2 plants counted).
- UNITED STATES. Louisiana: Caddo Par., 4.8 mi. E of state line on US 79, T16N R16W, W side of road, fine grained sand soil, W facing slope, 31 May 1978, *M.J. Warnock 600* (ILL,MO,PAC,SHST,TEX);  $n=16$ ; (1 plant counted).
- UNITED STATES. Texas: Panola Co., 2.0 mi. S Jct. Rt. 31 and US 79 on 31, E of road, above ditch and in pasture, W facing slope, 31 May 1978, *M.J. Warnock 601* (ILL,SHST,TEX);  $n=8$ ; (4 plants counted).
- UNITED STATES. Texas: Panola Co., 2.0 mi. S Jct. Rt. 31 and US 79 on 31, E of road, above ditch and in pasture, W facing slope, 31 May 1978, *M.J. Warnock 601* (ILL,SHST,TEX);  $n=16$ ; (1 plant counted).
- UNITED STATES. Texas: Nacogdoches Co., 0.3 mi. N Jct. US 259 and FM 1087 on 259, E of road, NW facing slope, sandy soil, 31 May 1978, *M.J. Warnock 603* (ILL,PAC,SHST,TEX);  $n=8$ ; (4 plants counted).
- UNITED STATES. Texas: Nacogdoches Co., 0.3 mi. N Jct. US 259 and FM 1087 on 259, E of road, NW facing slope, sandy soil, 31 May 1978, *M.J. Warnock 603* (ILL,PAC,SHST,TEX);  $n=16$ ; (1 plant counted).
- UNITED STATES. Texas: Nacogdoches Co., 1.0 mi. N Jct. US 259 and FM 1087 on 259, E of road, W facing slope, sandy soil, 31 May 1978, *M.J. Warnock 605* (ILL,PAC,SHST,TEX);  $n=8$ ; (29 plants counted).
- UNITED STATES. Texas: Leon Co., 1.6 mi. E Jct. Rt. 7 and FM 1511 on 7, S side of road, sandy gravel soil, 31 May 1978, *M.J. Warnock 609* (ILL,TEX);  $n=8$ ; (17 plants counted).
- UNITED STATES. Texas: Leon Co., 1.6 mi. E Jct. Rt. 7 and FM 1511 on 7, S side of road, sandy gravel soil, 31 May 1978, *M.J. Warnock 609* (ILL,TEX);  $n=16$ ; (1 plant counted).
- UNITED STATES. Texas: Grimes Co., 2.4 mi. W Jct. FM 149 and Rt. 90 on 149, N of road, slight W facing slope, grassland, 7 Apr 1990, *M.J. Warnock 8198* (SHST);  $n=8$ ; (22 plants counted).
- UNITED STATES. Texas: San Augustine Co., Weches Outcrop, Halley Property, ca. 2 mi. SE San Augustine,  $94^{\circ} 05' 06''$  W  $31^{\circ} 31' 30''$  N, level to slight N facing slope, thin soil, 350 ft. elevation, 9 Apr 1990, *M.J. Warnock 8237* (SHST);  $n=8$ ; (11 plants counted).
- UNITED STATES. Texas: Trinity Co., 5.4 mi. W Jct. Rt. 94 and US 287 on Rt. 94, N of road, nearly level soil, 4 May 1990, *M.J. Warnock 8381* (SHST);  $n=8$ ; (12 plants counted).
- UNITED STATES. Texas: Trinity Co., 5.4 mi. W Jct. Rt. 94 and US 287 on Rt. 94, N of road, nearly level soil, 4 May 1990, *M.J. Warnock 8381* (SHST);  $n=16$ ; (2 plants counted).
- UNITED STATES. Texas: San Augustine Co., 1.3 mi. N Jct. Rt. 147 and FM 1279E on 147, Sabine National Forest, sandy soil, S facing slope, 5 May 1990, *M.J. Warnock 8399* (SHST);  $n=8$ ; (14 plants counted).

- UNITED STATES. Texas: Harrison Co., 3.7 mi. SE Jct. Rt. 31 and I-20 on Rt. 31, N of road, nearly level soil, 5 May 1990, *M.J. Warnock 8403* (SHST);  $n=8$ ; (22 plants counted).
- UNITED STATES. Texas: Harrison Co., 3.7 mi. SE Jct. Rt. 31 and I-20 on Rt. 31, N of road, nearly level soil, 5 May 1990, *M.J. Warnock 8403* (SHST);  $n=16$ ; (2 plants counted).
- UNITED STATES. Texas: Van Zandt Co., NW area of interchange of I-20 and FM 1255, nearly level soil, 5 May 1990, *M.J. Warnock 8404* (SHST);  $n=8$ ; (24 plants counted).
- UNITED STATES. Texas: Bastrop Co., 5.3 mi. SW Jct. Rt. 21 and US 290 on Rt. 21, E of road, sandy soil, slight S facing slope, 6 May 1990, *M.J. Warnock 8415* (SHST);  $n=8$ ; (19 plants counted).
- UNITED STATES. Texas: Bastrop Co., 5.3 mi. SW Jct. Rt. 21 and US 290 on Rt. 21, E of road, sandy soil, slight S facing slope, 6 May 1990, *M.J. Warnock 8415* (SHST);  $n=16$ ; (1 plant counted).
- UNITED STATES. Texas: Walker Co., 0.4 mi. E Jct. FM 1696 and I-45 on 1696 extension, S of road, NW facing slope, sandy soil, 8 May 1990, *M.J. Warnock 8417* (SHST);  $n=8$ ; (3 plants counted).
- UNITED STATES. Texas: Walker Co., 0.4 mi. E Jct. FM 1696 and I-45 on 1696 extension, S of road, NW facing slope, sandy soil, 8 May 1990, *M.J. Warnock 8417* (SHST);  $n=16$ ; (1 plant counted).
- UNITED STATES. Texas: Madison Co., 0.3 mi. S Jct. Terdanway Rd. and FM 2548 on Terdanway Rd., E of road, sandy soil, nearly level ground, 8 May 1990, *M.J. Warnock 8418* (SHST);  $n=8$ ; (24 plants counted).
- UNITED STATES. Texas: Cherokee Co., Old Palestine Cemetery, 1.1 mi. W Jct. Rt. 21 and FM 241 on 21, S of road, slight S facing slope, sandy soil, 8 May 1990, *M.J. Warnock 8419* (SHST);  $n=8$ ; (23 plants counted).
- UNITED STATES. Texas: Panola Co., SW of Jct. US 79 and Panola Co. 108, N facing slope, sandy soil, 8 May 1990, *M.J. Warnock 8420* (SHST);  $n=8$ ; (26 plants counted).
- UNITED STATES. Texas: Panola Co., SW of Jct. US 79 and Panola Co. 108, N facing slope, sandy soil, 8 May 1990, *M.J. Warnock 8420* (SHST);  $n=16$ ; (2 plants counted).
- UNITED STATES. Louisiana: Caddo Par., 2.7 mi. S Jct. US 79 and I-20 on 79, W of road, SE facing slope, sandy soil, 8 May 1990, *M.J. Warnock 8421* (SHST);  $n=8$ ; (17 plants counted).
- UNITED STATES. Louisiana: Caddo Par., 2.7 mi. S Jct. US 79 and I-20 on 79, W of road, SE facing slope, sandy soil, 8 May 1990, *M.J. Warnock 8421* (SHST);  $n=16$ ; (1 plant counted).
- UNITED STATES. Louisiana: Bienville Par., 0.1 mi. E Jct. Rt. 4 and Rt. 9, N of road, sandy soil, slight E facing slope, 8 May 1990, *M.J. Warnock 8422* (SHST);  $n=8$ ; (20 plants counted).
- UNITED STATES. Texas: Cass Co., 1.9 mi. E Jct. FM 3129 and US 59 on 3129, N of road, sandy soil, S facing slope, 11 May 1990, *M.J. Warnock 8445* (SHST);  $n=8$ ; (23 plants counted).

Reported as  $n=8,16$  by Warnock (1981) without further documentation. That report based on those collections reported above and made before 1979. No other reports for *Delphinium carolinianum* subsp. *vimineum* have been seen.

*Delphinium carolinianum* Walter subsp. *virescens* (Nutt.) R.E. Brooks

UNITED STATES. Oklahoma: Ellis Co., 20.7 mi. E Jct. US 60 and Rt. 283 on 60, just W of rest area, T19N R21W, S of road, low area in prairie hills, sandy soil, 8 Jun 1978, *M.J. Warnock 711* (ILL,SHST,TEX);  $n=8$ ; (16 plants counted).

UNITED STATES. Colorado: Larimer Co., 1.5 mi. W Jct. County Road 19 and County Road 38E on 38E, W side of road, steep E facing slope, sandstone, 15 Jun 1978, *M.J. Warnock 857* (ILL,SHST,TEX);  $n=8$ ; (17 plants counted).

UNITED STATES. Iowa: Monona Co., hill prairie just NE of Turin, T83N R44W, loess soil, SW facing slope, 18 Jun 1978, *M.J. Warnock 904* (ILL,SHST,TEX);  $n=8$ ; (3 plants counted).

UNITED STATES. Texas: Tom Green Co., 3.1 mi. W Jct. FM 388 and FM 1692 on 388, N of road, slight N facing slope on limestone, *Prosopis* woods, 18 Apr 1979, *M.J. Warnock, P.P. Lowry, & A.G. Jones 1788* (ILL);  $n=8$ ; (3 plants counted).

Reported by Gregory (1941) with a count of  $n=8$  (as *Delphinium penardii* Huth), Keener (1976) as  $2n=16$  (as *D. virescens* Nutt.), Warnock (1981) with a count of  $n=8$  (as *Delphinium carolinianum* subsp. *penardii* [Huth] Warnock), and by Löve & Löve (1982) as  $2n=16$  (as *D. virescens*). Gregory's count was performed on plants grown from seed at the Blandy Experimental Farm at the University of Virginia. Gregory does not mention whether or not voucher specimens were made and deposited, nor what the source of seeds was. Keener's (1976) report is without further documentation, as is that of Warnock (1981), although the latter is based on the counts reported here. The count by Löve & Löve is based on a specimen from Manitoba and represents *D. carolinianum* subsp. *virescens*.

*Delphinium decorum* Fisch. & C.A. Meyer subsp. *tracyi* Ewan

Reported by Lewis *et al.* (1951) as  $2n=16$  based on two collections from California. Both Lewis *et al.* collections come from an area that suggests the specimens are accurately identified. Kurita (1956) reported *Delphinium decorum* as  $2n=32$ . The source of Kurita's material is not clear, nor does the collection appear to be vouchered. Therefore, Kurita's report was not included in the *Flora of North America* manuscript.

*Delphinium depauperatum* Torrey & A. Gray

Ornduff (1958) reported *Delphinium depauperatum* (as *D. cyanoreizos*) as  $n=8$  based on three specimens from Idaho. These specimens are accurately identified as *D. depauperatum*. Sutherland (1967) reported a count of  $n=8$  based on a specimen from Idaho. Sutherland's collection is also *D. depauperatum*.

*Delphinium distichum* Geyer ex Hook.

Sutherland (1967) reported *Delphinium distichum* as  $n=8$  based on "repeated estimate" of chromosome number in a collection from Yakima Co., Washington. Sutherland's specimen is accurately identified as *D. distichum*.

*Delphinium elatum* L.

Lewitsky (1931) reported *Delphinium elatum* as  $2n=32$ , but did not cite a source for material. Propach (1940) reported *D. elatum* as  $2n=32$  based on a specimen collected in the wild. It is not clear whether or not this collection was vouchered. Karatshova *et al.* (1974) reported *D. elatum* as  $2n=32$  based on a collection from the Ob Region of Russia. I have not seen a voucher of this collection and neither of the two previous reports was included in the *Flora of North America* manuscript because the source of material was not North American. Al-Kelidar & Richards (1981) also reported  $2n=32$ , but cite source material having been received under several different binomials (some under names of North American species), and I have not seen voucher specimens for any of them.

*Delphinium exaltatum* W.T. Aiton

Al-Kelidar & Richards (1981) cite *Delphinium exaltatum* as a name on source material they grew and identified as *D. elatum*, and for which they report a chromosome number of  $2n=32$ . No voucher specimen has been seen, nor is a source of the material given. Due to uncertainties associated with it, this report is not included in the *Flora of North America* manuscript.

*Delphinium geraniifolium* Rydb.

UNITED STATES. Arizona: Coconino Co., 0.1 mi. N US 180 on Snow Bowl Road, W of road, Coconino National Forest, silty soil at edge of large meadow, 16 Aug 1978, *M.J. Warnock 1692* (ILL,SHST,TEX);  $n=8$ ; (4 plants counted).

No previous reports for *Delphinium geraniifolium* have been located.

*Delphinium geyeri* Greene

UNITED STATES. Colorado: Larimer Co., near high point of road to N, just N of Dixon Canyon Dam at Horsetooth Reservoir, T7N R69W, steep W facing slope, rocky, many shrubs, 15 Jun 1978, *M.J. Warnock 859* (ILL,SHST,TEX);  $n=8$ ; (32 plants counted).

UNITED STATES. Wyoming: Carbon Co., 3.2 mi. N Jct. Carbon County 351 and US 30 on 351, T21N R86W, E of road, slightly rolling sage prairie, gravelly sand soil, 16 Jun 1978, *M.J. Warnock 874* (ILL,SHST,TEX);  $n=8$ ; (26 plants counted).

UNITED STATES. Wyoming: Natrona Co., ca. 5 mi. S Jct. Rt. 220 and Kortess Dam Road, T30N R82W, W of road, E facing slope above roadcut, sagebrush prairie, sandy soil, 16 Jun 1978, *M.J. Warnock 880* (ILL,SHST,TEX);  $n=8$ ; (7 plants counted).

UNITED STATES. Colorado: Larimer Co., ca. 0.2 mi. S of Livermore on US 287, E side of road, NW facing slope, sandy soil, 18 Jul 1978, *M.J. Warnock 1270* (ILL,TEX);  $n=8$ ; (9 plants counted).

UNITED STATES. Wyoming: Albany Co., Rt. 130 at stream ca. 0.5 mi. E of Centennial, S of road, S facing slope, rocky sand stream sediments, grassland, 19 Jul 1978, *M.J. Warnock 1278* (ILL,SHST,TEX);  $n=8$ ; (2 plants counted).

Previously reported by Al-Kelidar & Richards (1981) as  $2n=32$ . However, the material they counted and reported was sent to them as seeds under the name



*Delphinium decorum* Fisch. & C.A. Meyer, and since I have not seen their voucher specimen (NCE) I cannot confirm their identification. Crawford & Gardener (1974) reported *D. geyeri* as  $2n=16$  based on three collections from Colorado and Wyoming.

*Delphinium glaucum* (S. Wats.) S. Wats.

UNITED STATES. Wyoming: Carbon Co., Rt. 130, ca. 1 mi. S Medicine Bow National Forest Boundary, 0.9 mi. S Brush Creek Campground entrance, Medicine Bow National Forest, W of road, in willows along stream, 19 Jul 1978, *M.J. Warnock 1314* (ILL,SHST);  $n=8$ ; (5 plants counted).

Previously reported as  $2n=16$  by Lewis *et al.* (1951 [based on a specimen from San Bernardino Co., California]) and Crawford & Gardener (1974 [as *Delphinium occidentale* based on two collections from Wyoming]), and  $2n=32$  by Al-Kelidar & Richards (1981). The Al-Kelidar & Richards (1981) report is somewhat dubious since they listed this as a taxon where "it has not been possible to verify source names." Ward & Spellenberg (1982 [as *D. occidentale*]) report *D. glaucum* as  $n=8$  based on a specimen from Park Co., Wyoming. The specimens of Lewis *et al.*, Crawford & Gardener, and Ward & Spellenberg appear to be accurately placed as *D. glaucum*.

*Delphinium gypsophilum* Ewan subsp. *gypsophilum*

Lewis *et al.* (1951) reported as  $2n=16$  (based on a collection [*Lewis & Epling 531*] from Kern Co., California and  $2n=32$  (based on collections [*Lewis & Epling 530, 537, 713, 715, Lewis & Mehlquist 441, 451, 454*] from California). Each of these are *Delphinium gypsophilum* subsp. *gypsophilum*. Additional collections (beyond those listed above) cited in Lewis *et al.* under *D. gypsophilum* either represent *D. gypsophilum* subsp. *parviflorum*, or the specimens have not been examined.

*Delphinium gypsophilum* Ewan subsp. *parviflorum* F.H. Lewis & Epling

Lewis *et al.* (1951) reported as  $2n=16$  based on collections (*Epling 735, Lewis & Epling 657, 661, 664, 689, 692, 694, 697, 698, 699, 782*) from California and listed as *Delphinium gypsophilum* subsp. *gypsophilum*. I have examined all of these with the exception of *Epling 735* and *Lewis & Epling 692, 694*, and find them to be *D. gypsophilum* subsp. *parviflorum*.

*Delphinium hansenii* Greene subsp. *ewanianum* M.J. Warnock

UNITED STATES. California: Madera Co., N of Jct. Co. Rd. 415 and Co. Rd. 400, SW facing slope, open oak woods, 23 Mar 1990, *M.J. Warnock 8179* (SHST)  $n=16$ ; (3 plants counted)

Lewis *et al.* (1951 [as *Delphinium hansenii*]) cited several specimens from California indicating that *D. hansenii* subsp. *ewanianum* is  $2n=32$ . From among these, identifications of *Epling 564*, and *569*, have been examined and their identifications confirmed as *D. hansenii* subsp. *ewanianum*.

*Delphinium hansenii* Greene subsp. *hansenii*

Lewis *et al.* (1951) cited numerous specimens from California indicating that *Delphinium hansenii* subsp. *hansenii* is  $2n=16$  or  $2n=32$ . From among these, identifications of Epling 561, 563, Epling & Mehlquist 470, and Lewis & Epling 606 (all  $2n=16$ ) and Epling 582 and Epling 578 (both  $2n=32$ ) have been examined and their identifications confirmed as *D. hansenii* subsp. *hansenii*.

*Delphinium hansenii* Greene subsp. *kernense* (Davidson) Ewan

Lewis *et al.* (1951 [as *Delphinium hansenii*]) cited numerous specimens from California indicating that *D. hansenii* subsp. *kernense* is  $2n=16$ . From among these, identifications of Lewis, Epling, & Mehlquist (24 May 1943, 12.5 mi. S of Bodfish) and Lewis, Epling, & Mehlquist (24 May 1943, near Fairview) have been examined and their identifications confirmed as *D. hansenii* subsp. *kernense*.

*Delphinium hesperium* A. Gray subsp. *cuyamaca* (Abrams) F.H. Lewis & Epling

Lewis *et al.* (1951 [as *Delphinium hesperium* var. *cuyamaca*]) reported as  $2n=16$  based on two specimens from San Diego Co., California. These specimens appear to be accurately identified.

*Delphinium hesperium* A. Gray subsp. *hesperium*

Lewis *et al.* (1951) reported *Delphinium hesperium* as  $2n=16$  based upon numerous specimens from California. These specimens appear to be accurately identified.

*Delphinium hesperium* A. Gray subsp. *pallescens* (Ewan) F.H. Lewis & Epling

Lewis *et al.* (1951 [as *Delphinium hesperium* f. *pallescens*]) reported as  $2n=16$  based upon numerous specimens from California. Lewis & Epling 709 and Lewis & Epling (6 May 1944, Beck Rd.) have been examined and confirmed as *D. hesperium* subsp. *pallescens*. Additional specimens cited also appear to be accurately identified.

*Delphinium luteum* A. Heller

Guerrant (1978) reported *Delphinium luteum* as  $n=8$ . This count was not vouchered.

*Delphinium menziesii* DC. subsp. *menziesii*

Reported by Sutherland (1967 [as *Delphinium menziesii* var. *menziesii*]) as  $n=8$  based on a specimen from Skagit Co., Washington. This specimen is included within the current circumscription of *D. menziesii* subsp. *menziesii*.

*Delphinium menziesii* DC. subsp. *pallidum* M.J. Warnock

Reported by Sutherland (1967 [as *Delphinium menziesii* var. *pavonaceum* ined.]) as  $n=8$  based on a specimen from Benton Co., Oregon. This specimen is included within the current circumscription of *D. menziesii* subsp. *pallidum*.

*Delphinium multiplex* (Ewan) C.L. Hitchc.

Reported by Ornduff (1957 [as *Delphinium cyanoreios* f. *multiplex*]) as  $n=8$  based on a specimen from Kittitas Co., Washington. This specimen appears to be *D. multiplex*.

*Delphinium novomexicanum* Wooton

UNITED STATES. New Mexico: Lincoln Co., 2.3 mi. W Jct. Rt. 532 and Rt. 37 on 532, T11S R12E Sec. 31 SE 1/4, Lincoln National Forest, S of road, S facing slope, meadow, silty soil with scattered rocks, 13 Aug 1978, M.J. Warnock 1600 (ILL,TEX);  $n=8$ ; (2 plants counted).

Reported by Spellenberg (1979) as  $n=8$  based on a specimen from Lincoln Co., New Mexico. This specimen is accurately identified as *Delphinium novomexicanum*.

*Delphinium nudicaule* Torrey & A. Gray

Tjebbes (1927) and Lawrence (1936) both reported *Delphinium nudicaule* as  $2n=16$ , but neither cited a source for material. Propach (1940) reported *D. nudicaule* as  $2n=16$  based on seeds received from a commercial source. Voucher specimens have not been seen, nor were they mentioned in Propach's paper. Lewis *et al.* (1951) reported *D. nudicaule* as  $2n=16$  based on several collections from California. These specimens appear to be accurately identified.

*Delphinium nuttallianum* Pritz.

UNITED STATES. Colorado: Larimer Co., N lateral moraine at Moraine Park, Rocky Mountain National Park, T5N R73W Sec. 31, NW 1/4, 8250-8600 ft., S facing slope, rocky soil, 15 Jun 1978, M.J. Warnock 827 (ILL);  $n=8$ ; (1 plant counted).

Previously reported by Lewis *et al.* (1951 [based on a specimen from Nevada Co., California]), Ornduff (1957 [as *Delphinium bicolor* f. *helleri* based on a specimen from Crook Co., Oregon]), Wiens & Halleck (1962 [as *D. nelsonii* E. Greene based on a specimen from Boulder Co., Colorado]), Sutherland (1967 [as *D. menziesii* var. *levicaule* *ined.* based on a specimen from Kittitas Co., Washington]), Hartman & Crawford (1971 [as *D. nelsonii* based on a specimen from Wyoming]), and Crawford & Gardener (1974 [as *Delphinium nelsonii* based on specimens from Wyoming]) as  $2n=16$ .

*Delphinium nuttallii* A. Gray subsp. *nuttallii*

Reported by Sutherland (1967) as  $n=8$  based on a specimen from Cowlitz Co., Washington. This specimen is accurately identified.

*Delphinium nuttallii* A. Gray subsp. *ochroleucum* M.J. Warnock

Reported by Sutherland (1967 [as *Delphinium nuttallii* var. *ochroleucum* *ined.*]) as  $n=8$  based on a specimen from Clackamas Co., Oregon. This specimen falls within the current circumscription of *D. nuttallii* subsp. *ochroleucum*.

*Delphinium parishii* A. Gray subsp. *pallidum* (Munz) M.J. Warnock

Lewis *et al.* (1951 [as *Delphinium inopinum*]) reported as  $2n=16$  based on three specimens from Ventura Co., California. These specimens have been examined and represent what is currently recognized as *D. parishii* subsp. *pallidum*.

*Delphinium parishii* A. Gray subsp. *parishii*

Lewis *et al.* (1952) reported *Delphinium parishii* as  $2n=16$  based on numerous collections from California. The Lewis *et al.* collections appear to be accurately identified.

*Delphinium parryi* A. Gray subsp. *blochmaniae* (Greene) F.H. Lewis & Epling

Lewis *et al.* (1951 [as *Delphinium parryi* var. *blochmanae*]) reported as  $2n=16$  based on four specimens from San Luis Obispo Co., California. These specimens appear to be accurately identified.

*Delphinium parryi* A. Gray subsp. *maritimum* (Davidson) M.J. Warnock

Lewis *et al.* (1951 [as *Delphinium parryi*]) reported as  $2n=16$  based on *Lewis 631* from Los Angeles Co., California. This specimen falls within the current circumscription of *D. parryi* subsp. *maritimum*.

*Delphinium parryi* A. Gray subsp. *parryi*

Lewis *et al.* (1951 [as *Delphinium parryi* and *D. parryi* subsp. *seditionum*]) reported as  $2n=16$ . Included among the Lewis *et al.* citations are specimens of *D. parryi* subsp. *maritimum* and *D. parryi* subsp. *purpureum*, but most of the collections represent *D. parryi* subsp. *parryi*.

*Delphinium parryi* A. Gray subsp. *purpureum* (F.H. Lewis & Epling) M.J. Warnock

Lewis *et al.* (1951 [as *Delphinium parryi*]) reported as  $2n=16$  based on *Lewis & Epling 754* from Ventura Co., California. This specimen represents what is currently recognized as *D. parryi* subsp. *purpureum*.

*Delphinium patens* Benth. subsp. *hepaticoideum* Ewan

Lewis *et al.* (1951 [as *Delphinium patens*]) reported as  $2n=16$  based on *Mehlquist 390* from Santa Barbara Co., California. This specimen appears accurately identified as *D. patens* subsp. *hepaticoideum*.

*Delphinium patens* Benth. subsp. *patens*

Lewis *et al.* (1951) report (as *Delphinium gracilentum* based on a collection from Butte Co., California) as  $2n=16$ . Specimens of this collection in the herbarium at LA have been identified as *D. patens* subsp. *patens*. Lewis *et al.* (1951) also report (as *D. patens*) *Mehlquist 316A* as  $2n=16$ . This latter collection is *D. patens* subsp. *patens*.

*Delphinium pedatisectum* Hemsl.

MEXICO. Hidalgo: Llano Grande, ca. km 8 on road to El Chico, *Abies* forest and edges, N facing slope, 29 Aug 1980, M.J. Warnock, J.A. Norris, & S.P.

*McCormick 2204* (ENCB,ILL,MEXU,MO,NO,PAC,SHST,TEX);  $n=8$  (3 plants counted).

MEXICO. Querétaro: km 143 on Rt. 120, ca. 2 mi. E Pinal de Amoles, S of road, N facing roadcut, metamorphic rock face, 24 Nov 1980, *M.J. Warnock 2228* (ENCB,ILL,MEXU,MO,NO,PAC,SHST,TEX);  $n=8$  (2 plants counted).

MEXICO. Querétaro: km 136 on Rt. 120, ca. 2 mi. W Pinal de Amoles, S of road, W facing slope, *Pinus-Quercus* woods, 12 Oct 1981, *M.J. Warnock 2459* (ENCB,ILL,MEXU,PAC,TEX);  $n=8$  (3 plants counted).

MEXICO. Querétaro: km 143 on Rt. 120, ca. 2 mi. E Pinal de Amoles, S of road, N facing roadcut, metamorphic rock face, 12 Oct 1981, *M.J. Warnock 2462* (ENCB,ILL,MEXU,TEX);  $n=8$  (3 plants counted).

Reported as  $n=8$  by Warnock (1987) without further documentation, but that report based on the counts cited here. No additional counts for *Delphinium pedatisectum* have been located.

#### *Delphinium polycladon* Eastw.

Lewis *et al.* (1951) reported *Delphinium polycladon* as  $2n=16$  based on a specimen from Mariposa Co., California. This specimen appears to be accurately identified. Snow (1959) reported *D. polycladon* as  $2n=16$  based on *Snow 284* from Tuolumne Co., California. This specimen has been seen and its identification confirmed.

#### *Delphinium purpusii* Brandege

Lewis *et al.* (1951) report *Delphinium purpusii* as  $2n=16$  based on three collections from Kern Co., California. Specimens cited in Lewis *et al.* appear to be accurately identified.

#### *Delphinium ramosum* Rydb.

UNITED STATES. Colorado: Mineral Co., 13.6 mi. N Jct. Rt. 149 and US 160 on 149, E of road, steep SW facing rocky slope, scattered shrubs, 23 Jul 1979, *M.J. Warnock & R.W. Sterner 1935* (ILL,SHST);  $n=8$ ; (1 plant counted).

*Delphinium ramosum* has been previously reported as  $2n=16$  by Crawford & Gardener (1974) based on a collection from Las Animas Co., Colorado. This specimen has not been examined.

#### *Delphinium recurvatum* Greene

Lewis *et al.* (1951) report *Delphinium recurvatum* as  $2n=16$  based on three specimens from central California. One of these (*Epling & Miles 542*) has been examined and its identification confirmed as *D. recurvatum*.

#### *Delphinium scaposum* Greene

Spellenberg (1979) reported *Delphinium scaposum* as  $n=8$ . Identification of the voucher specimen appears to be correct.

*Delphinium scopulorum* A. Gray

UNITED STATES. Arizona: Apache Co., 5.4 mi. S Jct. US 666 and US 180 on 666, Apache National Forest, E of road, silty soil in meadow, T5N R30E, 15 Aug 1978, *M.J. Warnock 1672* (ILL,SHST,TEX);  $n=8$ ; (2 plants counted).

A count for *Delphinium scopulorum* was reported by Gregory (1941) as  $n=8$ . Gregory's count was performed on plants grown from seed at the Blandy Experimental Farm at the University of Virginia. Gregory does not mention whether or not voucher specimens were made and deposited, nor what the source of seeds was. The report had no further documentation, and given the common misapplication of the name *D. scopulorum* among specimens of many *Delphinium* species in western North America, it is not at all clear without a voucher, whether Gregory's plant was this or another.

*Delphinium subscandens* Ewan

MEXICO. Jalisco: ca. 9 mi. S of Rt. 15 on road to Tequila Microwave Station, N slope of Cerro Tequila, *Quercus* woods, N facing slope, rocky soil, 30 October 1981, *M.J. Warnock 2600* (ENCB,ILL,MEXU,MO,PAC,SHST,TEX,WIS);  $n=8$  (5 plants counted).

Reported by Warnock (1987) as  $n=8$  without further elaboration, but that report based on this count. No other reports for *Delphinium subscandens* have been located.

*Delphinium sutherlandii* M.J. Warnock

Ornduff (1957) reported *Delphinium sutherlandii* (as *D. nuttallianum*) as  $n=8$  based on a collection from Sanders Co., Montana. This specimen represents what is currently recognized as *D. sutherlandii*.

*Delphinium treleasei* Bush

UNITED STATES. Arkansas: Marion Co., 0.8 mi. W Jct. US 62 and Rt. 178 on 62, S of road above roadcut, thin soil on limestone, nearly level, *Juniperus* glade, 4 Jun 1981, *M.J. Warnock 2274* (ILL,MO,PAC,SHST,TEX);  $n=8$  (3 plants counted).

UNITED STATES. Arkansas: Carroll Co., 1.7 mi. S Jct. Rt. 187 and US 62 on 187, N of road, WSW facing slope, thin soil on limestone, *Juniperus* glade, 5 Jun 1981, *M.J. Warnock 2285* (ILL,MO,PAC,SHST,TEX);  $n=8$  (3 plants counted).

UNITED STATES. Missouri: Dade Co., 1.5 mi. E Jct. Rt. Y and Rt. H on Y, S of road, W facing slope, *Juniperus* glade, thin soil on limestone, 6 Jun 1981, *M.J. Warnock 2289* (ILL,MO,PAC,SHST,TEX);  $n=8$  (3 plants counted).

Warnock (1982) reported  $n=8$  based on the counts reported here. Smith *et al.* (1992) also reported  $n=8$  based on a specimen from Baxter Co., Arkansas. The specimen of Smith *et al.* has not been examined.

*Delphinium tricornes* Michx.

UNITED STATES. Illinois: McDonough Co., Bethel Twp., N side of Camp Creek, S facing slope, deciduous woods, gravelly soil, 10 May 1978, *M.J. Warnock* 415 (ILL);  $n=8$ ; (4 plants counted).

Previously reported by Keener (1976) as  $2n=16$ , Gregory (1941) as  $n=8$  (as *Delphinium tricornes*) and as  $2n=16$  (as *D. flexuosum* Raf.), and Kurita (1956) as  $2n=32$  (as *D. flexuosum* Raf.). Gregory's counts were performed on plants grown from seed at the Blandy Experimental Farm at the University of Virginia. Gregory does not mention whether or not voucher specimens were made and deposited, nor what the source of seeds was. Keener's (1976) report is without further documentation. Source of material for Kurita's count is unknown.

*Delphinium trolliifolium* A. Gray

Reported by Lewis *et al.* (1951 [based on specimens from Humboldt Co., California]) as  $2n=16$  and by Sutherland (1967 [based on a specimen from Multnomah Co., Oregon]) as  $n=8$ . These collections appear accurately identified as *Delphinium trolliifolium*. A report by Zhukova (1961) lists *D. trolliifolium* as  $2n=32$ , but does not appear to be vouchered, nor is a source of material cited.

*Delphinium umbraculorum* F.H. Lewis & Epling

Lewis *et al.* (1951) reported *Delphinium umbraculorum* as  $2n=16$  based on numerous collections from San Luis Obispo and Santa Barbara counties, California. From among these, specimens of Lewis & Epling 691 have been examined and confirmed as *D. umbraculorum*. The UC collection of Lewis & Epling 701 appears to be intermediate between *D. umbraculorum* and *D. parryi* subsp. *parryi*.

*Delphinium variegatum* (Torrey & A. Gray) subsp. *variegatum*

Lewis *et al.* (1951) reported *Delphinium variegatum* as  $2n=16$  and  $2n=32$ . This report was based on numerous collections from California. Among the collections cited, the tetraploid reports originate from the borders of the Central Valley, while the diploid reports come from throughout the range of *D. variegatum* subsp. *variegatum*. All of their cited specimens examined to date have been accurately identified as *D. variegatum*.

*Delphinium wislizeni* Engelm.

MEXICO. Chihuahua: 4.7 mi. E Mesa del Huracán on road to Las Varas, S of road, steep N facing slope, rhyolite rock outcrop, *Pinus* woods, 21 Aug 1980, *M.J. Warnock*, *J.A. Norris*, & *S.P. McCormick* 2116 (ENCB,ILL,MEXU,MO,PAC,SHST,TEX);  $n=8$  (4 plants counted).

MEXICO. Chihuahua: km 45 W of La Junta on road to Tomochic, S of road, steep N facing slope, rhyolite, open *Pinus* woods, 22 August 1980, *M.J. Warnock*, *J.A. Norris*, & *S.P. McCormick* 2128 (ENCB,ILL,MEXU,MO,PAC,SHST,TEX);  $n=8$  (20 plants counted).

MEXICO. Chihuahua: km 45 W of La Junta on road to Tomochic, S of road, steep N facing slope, rhyolite, open *Pinus* woods, 22 August 1980, *M.J. Warnock*,

- J.A. Norris, & S.P. McCormick 2128 (ENCB,ILL,MEXU,MO,PAC,SHST,TEX);  $n=16$  (1 plant counted).
- MEXICO. Durango: km 32 on Rt. 40 W of Ciudad Durango, steep E facing slope, E of road, open *Pinus-Juniperus* woods, rhyolitic rock outcrop, 25 Aug 1980, M.J. Warnock, J.A. Norris, & S.P. McCormick 2165 (ILL,TEX);  $n=8$  (7 plants counted).
- MEXICO. Chihuahua: N slope of La Bufa, above Cusihuirachi, steep N facing rhyolitic slope, *Quercus* woods, 23 Sep 1981, M.J. Warnock 2351 (ENCB,ILL,MEXU,MO,PAC,SHST,TEX);  $n=8$  (3 plants counted).

Reported but not otherwise documented by Warnock (1987) as  $n=8,16$ , based on the counts reported here. No other reports for *Delphinium wislizeni* have been located.

*Delphinium wootonii* Rydb.

- UNITED STATES. New Mexico: Doña Ana Co., 0.4 mi. after beginning of one way road to campground of Aguirre Springs Recreation Area, just SE of road on S facing slope, large granite boulders, desert scrub, 16 Apr 1979, M.J. Warnock, P.P. Lowry, & A.G. Jones 1787 (ILL,PAC,SHST,TEX);  $n=8$ ; (2 plants counted).

Previously reported without further documentation as  $n=8$  by Warnock (1981). That report based on the count documented here. No additional counts for *Delphinium wootonii* have been located.

*Delphinium xantholeucum* Piper

- Reported by Sutherland (1967) as  $n=8$  based on a specimen from Chelan Co., Washington. This collection is accurately identified.

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